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LARVAL DEVELOPMENT OF *DARGIDA PROCINCTA* (GROTE) (LEPIDOPTERA: NOCTUIDAE) IN THE PACIFIC NORTHWEST

J. A. Kamm
National Forage Seed Production Research Center,
U.S. Department of Agriculture, Agricultural Research Service,
Corvallis, Oregon 97331-7102

Abstract.—Larval growth of *D. procincta* (Grote) was regulated by temperature and larvae required 20.5 days at 27° C to complete larval development vs 51.2 days at 15° C. Duration of the pupal stage was 11.7 days at 27° C vs 36.7 days at 15° C. Photoperiod had no observable effect on larval development. The six instars were readily distinguished by the width of head capsule. Third instars, observed in the field in early April, are believed to emerge as adults in June and lay eggs for a second generation. Dense infestations of larvae were observed to develop on the lush spring growth of grasses but not on the fall regrowth of established or seedling stands of ryegrass.

Key Words.—Insecta, cutworm, grass pest, larval growth

Dargida procincta (Grote) is one of two representatives of the genus in the continental United States (Holland 1903, Hodges 1983). In the Pacific Northwest, the larvae are known to defoliate ryegrasses (Kamm 1985). Legumes are also host plants (Tietz 1972). The seasonal flight of adults is unknown because they are rarely captured in blacklight traps, even in fields with dense populations of larvae (Kamm 1985). Dyar (1898) and Godfrey (1972) briefly described the larvae and Spencer (1946) observed the oviposition behavior of females. Thompson (1943) considered the species an important pest of grasses in the Pacific Northwest. *Dargida procincta* was the most abundant cutworm species in commercial ryegrass grown for seed, but nothing is known about its larval development or the number of generations each year (Kamm 1985).

This paper reports the results of laboratory tests that document the number of instars and the influence of photoperiod and temperature on the rate of larval growth. Field observations were made and are discussed in relation to the seasonal cycle of *D. procincta* in ryegrass grown for seed in the Willamette Valley of Oregon.

Materials and Methods

A laboratory culture of *D. procincta* was initiated from larvae collected in a field of ryegrass near Corvallis, Oregon. All larvae were reared individually in stender dishes (5.0 × 2.5 cm), the bottoms of which were lined with damp blotting paper. Larvae were supplied with freshly cut leaves of ryegrass, *Lolium multiflorum* Lamarck, every 1–3 days. Controlled environment chambers were used to rear the stock cultures and to provide experimental treatments of light and temperature. A short day was a regime of 10 h light and 14 h dark (10:14 LD) and a long day was a regime of 16 h light and 8 h dark (16:8 LD). Adults obtained from larvae reared in the laboratory were confined in cages (20 × 20 × 50 cm) on ryegrass grown in the greenhouse to mate and to obtain eggs. Eggs laid on the foliage were removed and kept in stender dishes until they hatched. Experimental treatments were initiated the day of egg hatch.

Head capsule size was the criterion used to determine larval instars. Measurements were made across the widest part of the head capsule in dorsal view by using an ocular micrometer in a stereoscopic microscope. Head capsules were measured every other day during the test. Adults were dissected at different ages to determine the stage of ovarial development by methods described elsewhere (Kamm & Ritcher 1972). Specimens of reared adults have been deposited in the insect museum at Oregon State University. A sweep net was used to sample fields for larvae.

Results and Discussion

Description of Eggs and Larvae.—Females glue milky white eggs to the undersides of grass leaves and within leaf sheaths. The eggs are pumpkin shaped. Several days before hatch they develop a brown ring that encircles the egg, with a brown dot in the center of the ring. Each ovary has four ovarioles about twice the length of the abdomen. No mature eggs are visible in the ovaries when females emerge, but after females were fed a solution of 10% honey and water for a week, eggs of various sizes were present in the ovaries and females initiated oviposition. The ovaries removed from females collected in the field during July and August contained mature eggs.

Dargida procincta is described as being green with pale stripes or black with the pale stripes distinct (Crumb 1956, Godfrey 1972). When a large lot of larvae was reared in the laboratory to fourth instars, the basic body color was numerous shades of green (110), black (59), or brown (14). The color of the pale stripes was usually tan or brown, which may or may not have interrupted black markings that parallel the stripes. Because *D. procincta* is a leaf feeder, the different color morphs probably conceal some larvae from predators during seasonal changes in color of the grass.

Larval Growth.—Figure 1 shows the cumulative rates of growth of larvae exposed to a long-day regime at 21° C. Each instar was easily discerned by measurement of the head capsule. Progression through the instars was remarkably uniform, both in time between molt and the size of head capsule, except for the sixth instar. Unlike many Lepidoptera larvae (Beck 1980), photoperiod had no significant effect on the rate of larval growth at either 15 or 21° C (Table 1). No evidence was found that exposure of small larvae to short days and/or low temperatures induced diapause in either larvae or pupae. In temperature treatments with the same photoperiod, the rate of larval and pupal development nearly doubled ($P < 0.05$) when larvae were exposed to 15° C compared with those larvae exposed to 21° C.

Another experiment confirmed that larval growth was regulated by temperature when larvae were exposed to an expanded range of temperatures (Table 2). The duration of development for larvae, from egg to pupal stage, ranged from 20.5 days to 51.2 days. The duration of the pupal stage was 11.7 days at 27° C vs 36.7 days at 15° C. The ability of *D. procincta* to develop in cool temperatures and short daylengths without diapause or apparent pathological effect gives the species the advantage of using the early spring and autumn growth of cool-season grasses in the Pacific Northwest. During winter, larvae have been observed to feed during

Table 1. Effect of photoperiod at 15° and 21° C on the development of *D. procincta* larvae from time of egg hatch to adult.

Photoperiod	Temperature (°C)	No. of insects	$\bar{x}$ Time to develop (days)		
			Larvae	Pupae	Total (± SD)
16:8 LD	21	65	29.5	16.9	46.4 ± 1.9[a]
10:14 LD	21	61	28.8	18.5	47.3 ± 2.2
16:8 LD	15	31	54.4	34.4	88.8 ± 2.8
10:14 LD	15	34	52.0	39.7	91.7 ± 2.9

[a] Rate of development of larvae exposed to the same temperature and different photoperiods were not significantly different, but that of larvae exposed to the same photoperiod and different temperatures was significantly different (Mann-Whitney *U*-test, $P < 0.05$). Each treatment was initiated using 80 larvae.

warm periods in January. Second and third instars were easily collected on ryegrass foliage where they feed by sweeping fields during early April and are believed to be first-generation larvae that mature and pupate in ryegrass fields windrowed for harvest in mid-June (Kamm 1985). The presence of gravid females from May through August suggests a second generation of larvae in late summer. A few mature larvae that developed during the typical arid summer have been collected from September to December and are believed to be the wintering stage. In no case have dense larval infestations been observed in established or seedling fields of ryegrass during October and November suggesting that the species primarily exploits the lush spring growth of grass.

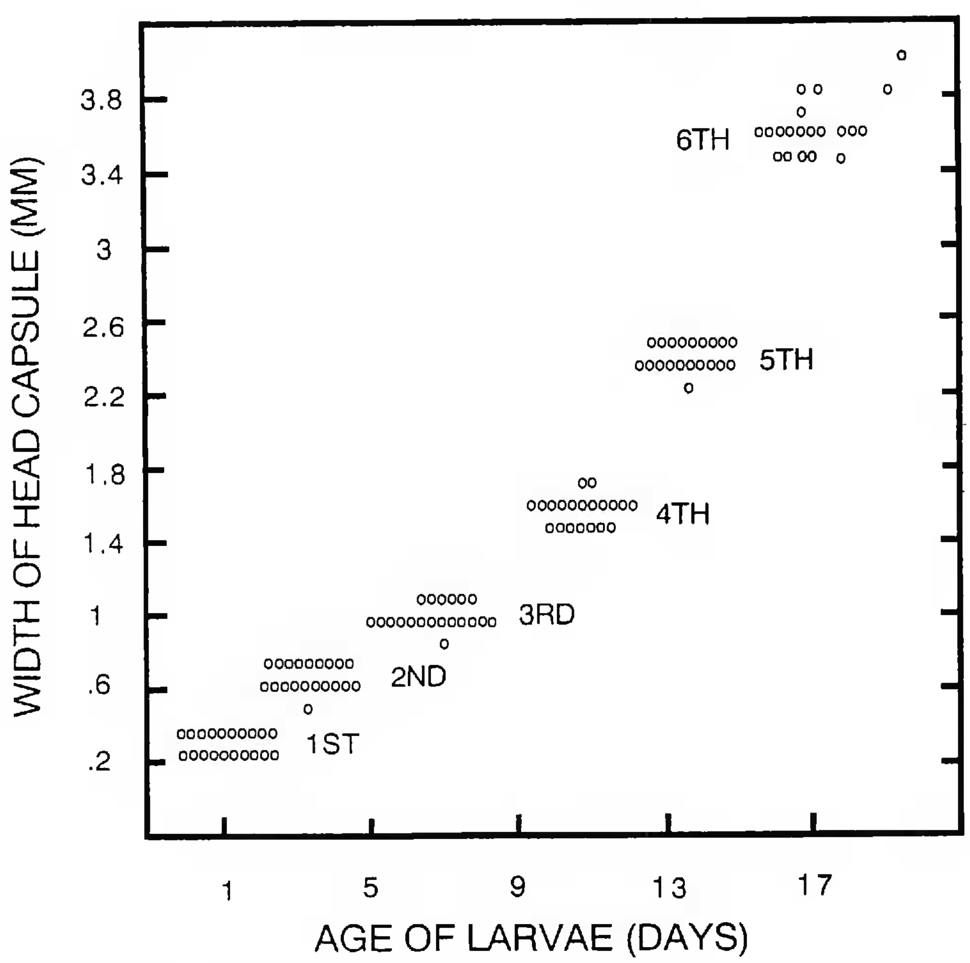

Figure 1. Progressive increase in the size of head capsule of larvae of *D. procincta* exposed to long daylengths at 21° C.

Table 2. Effect of temperature on rate of development when *D. procincta* larvae were exposed to different temperatures and long days (16:8 LD) from time of egg hatch to adult.

Temperature (°C)	No. of insects[a]	$\bar{x}$ Time to develop (days) Larvae	Pupae	Total (± SD)
27	22	20.5	11.7	32.2 ± 2.1
24	30	24.6	14.9	39.5 ± 1.2
21	44	25.0	16.4	41.4 ± 0.8
18	32	35.9	24.4	60.3 ± 3.3
15	29	51.2	36.7	87.9 ± 2.7

[a] Each treatment was initiated using 60 larvae.

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